Workshop Biodiversidade Funcional

12-Jun-2019

(MICRO)PLASTICS,

A MACROPROBLEM TO FRESHWATERS?

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DeBio & CESAM

Introduction

(Micro)Plastics – Source, Fate and Effect

- **3D:** different shape, size, and densities

  → **Heterogeneous distribution/dispersal**

- Contain **additives***

- Pervasive and **persistent**

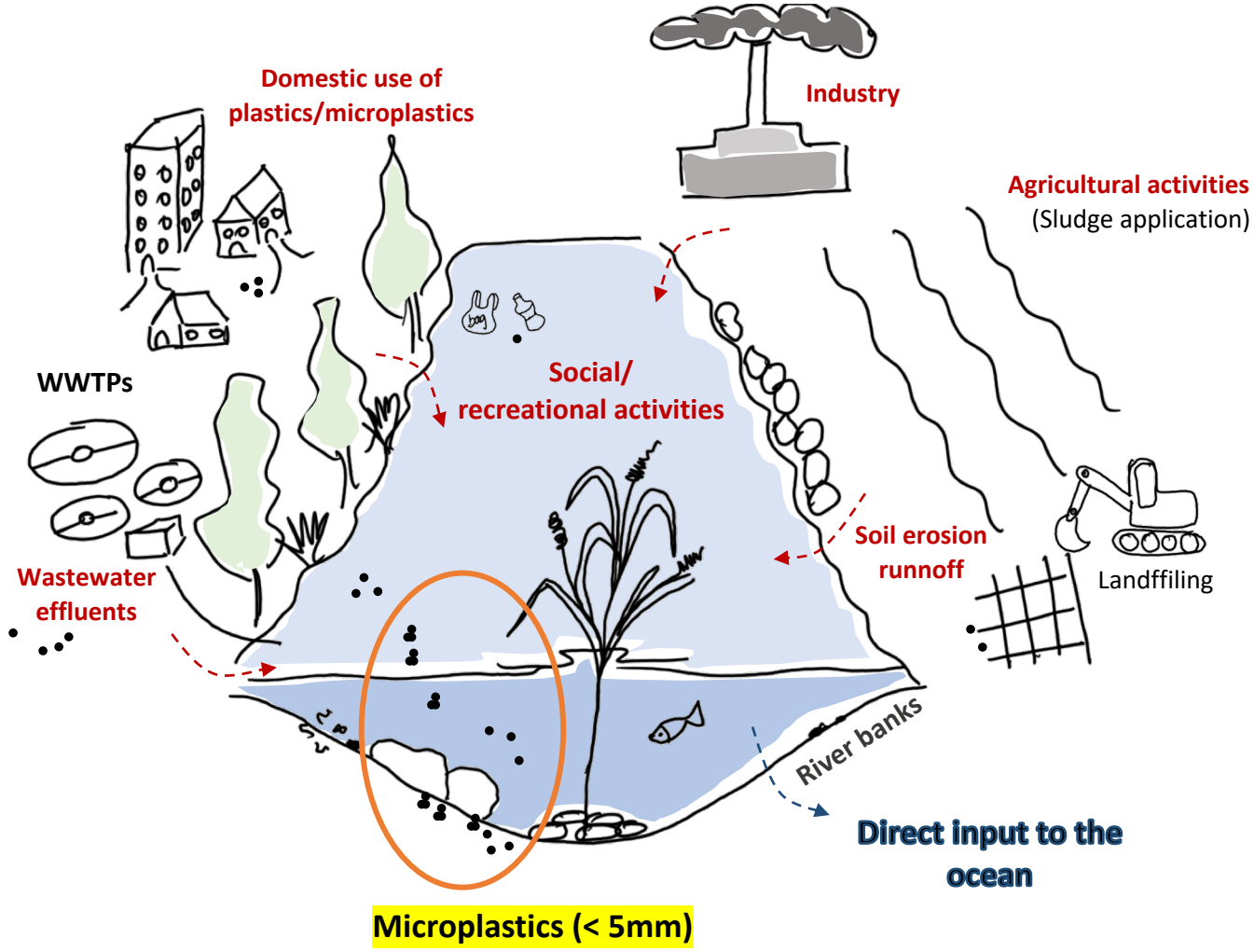
- Act as **vectors** of hazardous chemicals and pathogens

Introduction

(Micro)Plastics – Source, Fate and Effect

1. **Freshwaters** are the **main receptors of primary microplastics** from inland activities….

2. Freshwaters are **highways** of plastic debris and primary microplastics → **main destination: ocean**

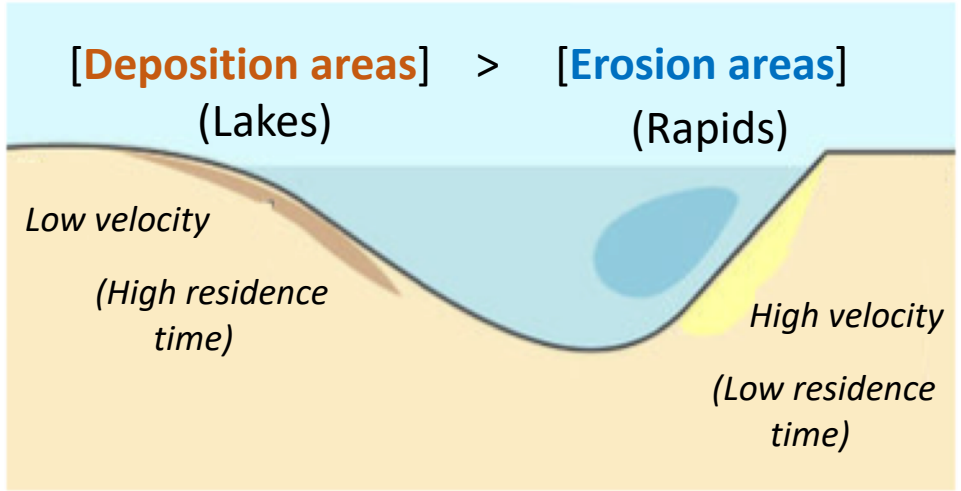


Introduction

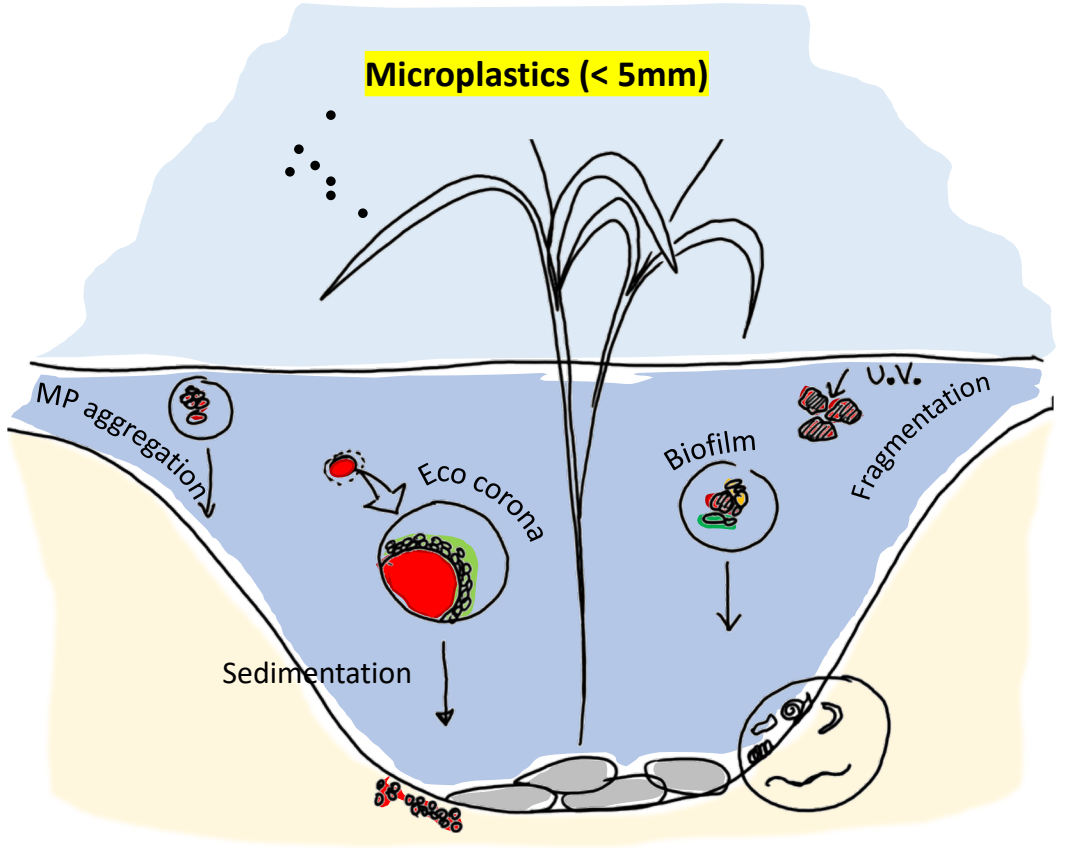
(Micro)Plastics in Freshwaters

[Sediments] > [Water]

e.g., 10 000 -100 000 particles. m^{-2}
River Mersey/ Irwell - UK; St Laurence – CA; Rhine-Main – GE
(reviewed by Hurley et al., 2018)



(reviewed by Tibbetts et al., 2018)



Introduction

(Micro)Plastics in Freshwaters

comPET project

ECOTOXICOLOGICAL EFFECTS OF MICROPLASTICS ON FRESHWATER ENVIRONMENTS

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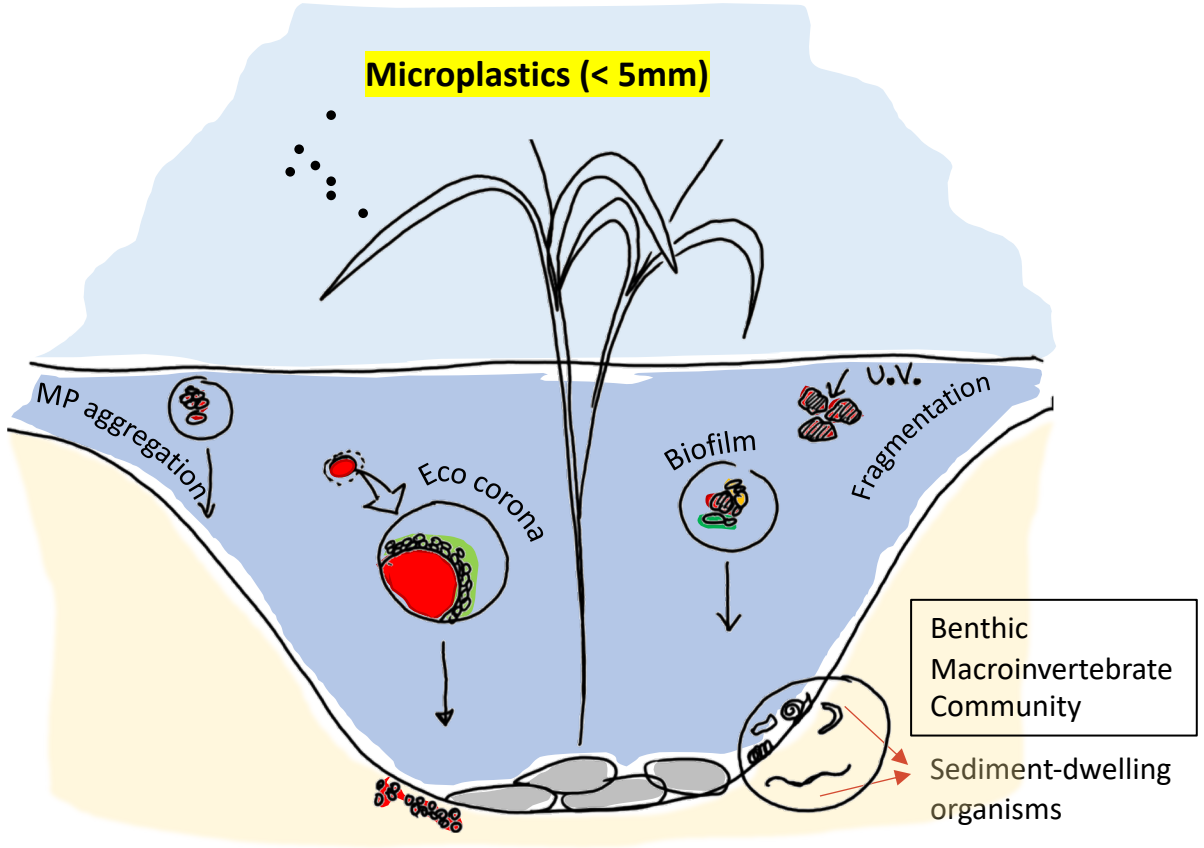

Risk to freshwater benthic organisms & communities

Project aims

compET project

ECOTOXICOLOGICAL EFFECTS OF MICROPLASTICS ON FRESHWATER ENVIRONMENTS

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1) Evaluate the presence and abundance of MPs in Portuguese rivers (Aveiro region)
2) Understand which MP characteristics (size, material, and shape) promote an uptake and what is the fate of MPs in the biota
3) Evaluate the effects of MPs exposure at different levels of biological organization (from genes to population; from communities to ecosystem services)
4) Assess the interaction between MPs and other pollutants
5) Understand how natural factors changes impact of MPs in the biota

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1st approach – Laboratory tests

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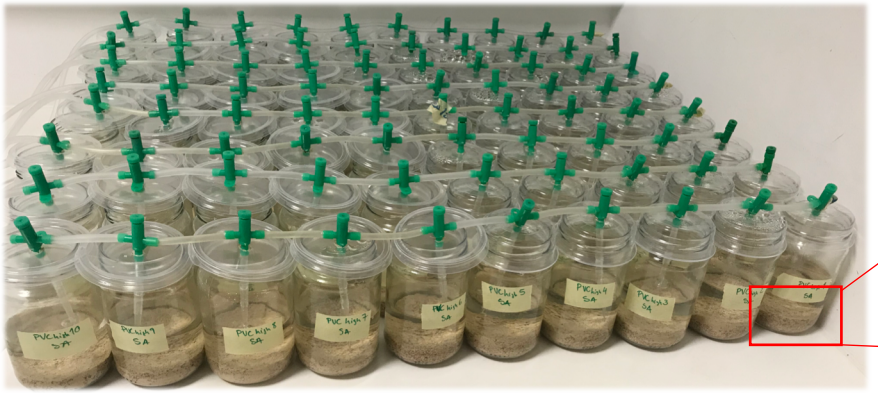
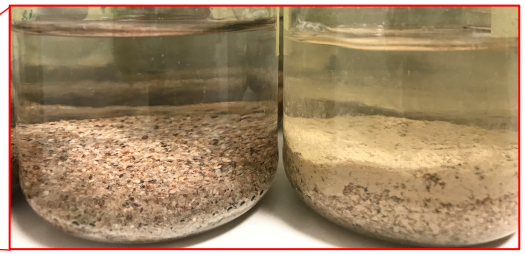
Different polymers (PE, PVC, PA,…), size (pools), shape (beads, irregularly-shaped, fibres) …. pristine vs aged… pristine vs field collected…

Different species



Different sediment types



Organismal and sub-organismal endpoints

- ✓ Behaviour, Ingestion
- ✓ Life-history traits
- ✓ Bioaccumulation
- ✓ Biochemical biomarkers
- ✓ Energy budget
- ✓ Gene-expression

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2nd approach – Mesocosms

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Using natural benthic communities from reference sites

Artificial streams

Different endpoints at community & ecosystem level

- ✓ Community structure
- ✓ Primary production
- ✓ Decomposition of OM
- ✓ Biomagnification

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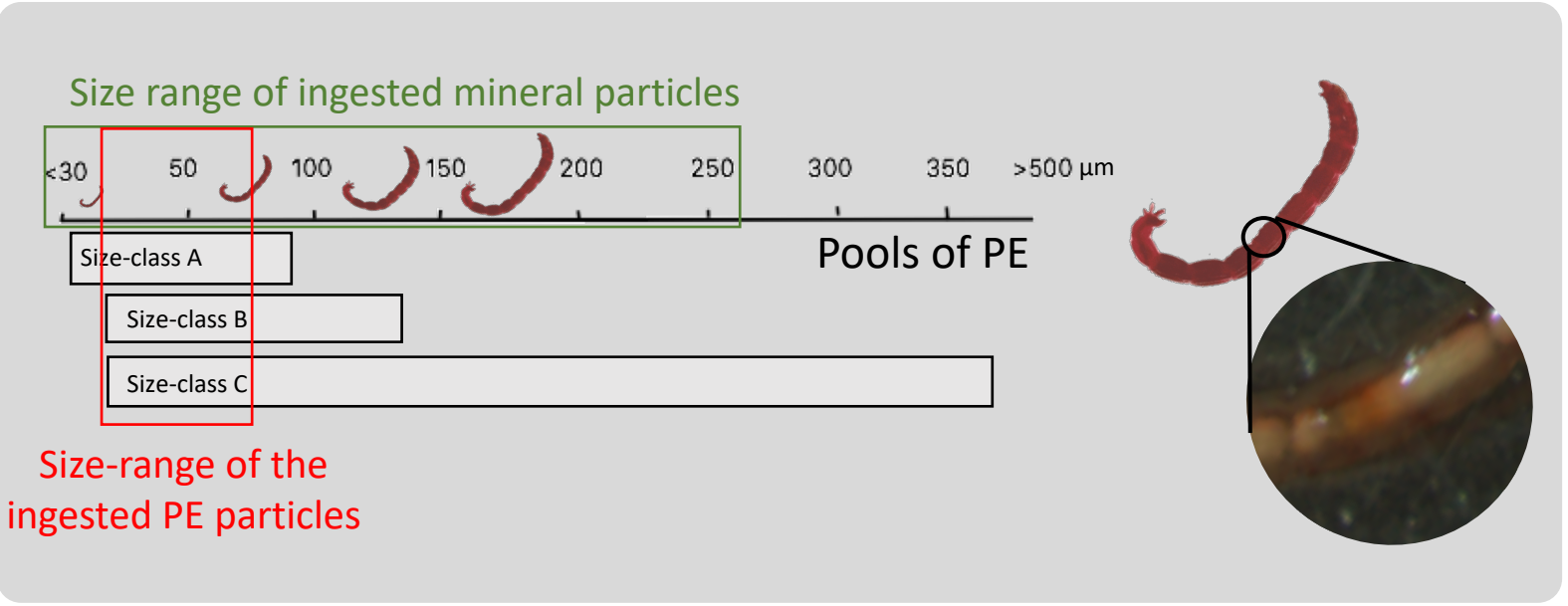
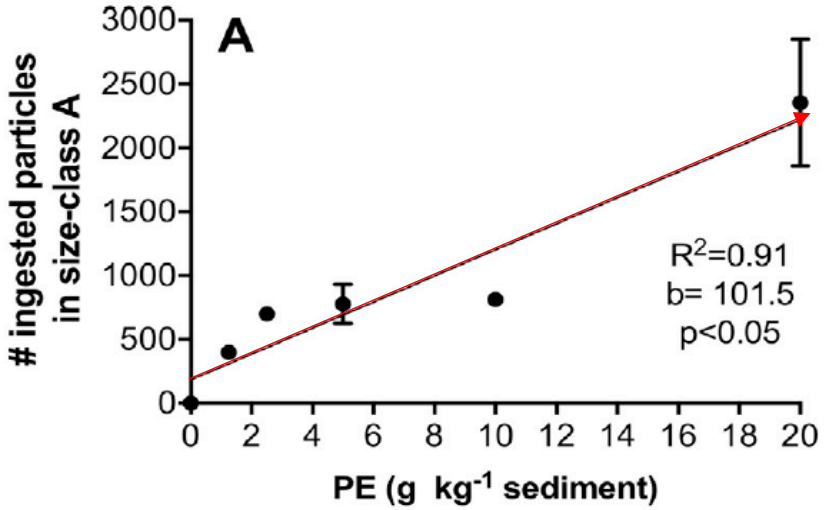
Results so far

♀ *Hi.. we're a non-bitting midge. We spend ~95% of our life spam in the water, as a sediment-dwelling larvae. We have sexual dimorphism and bimodal emergence* ♂

Science of the Total Environment

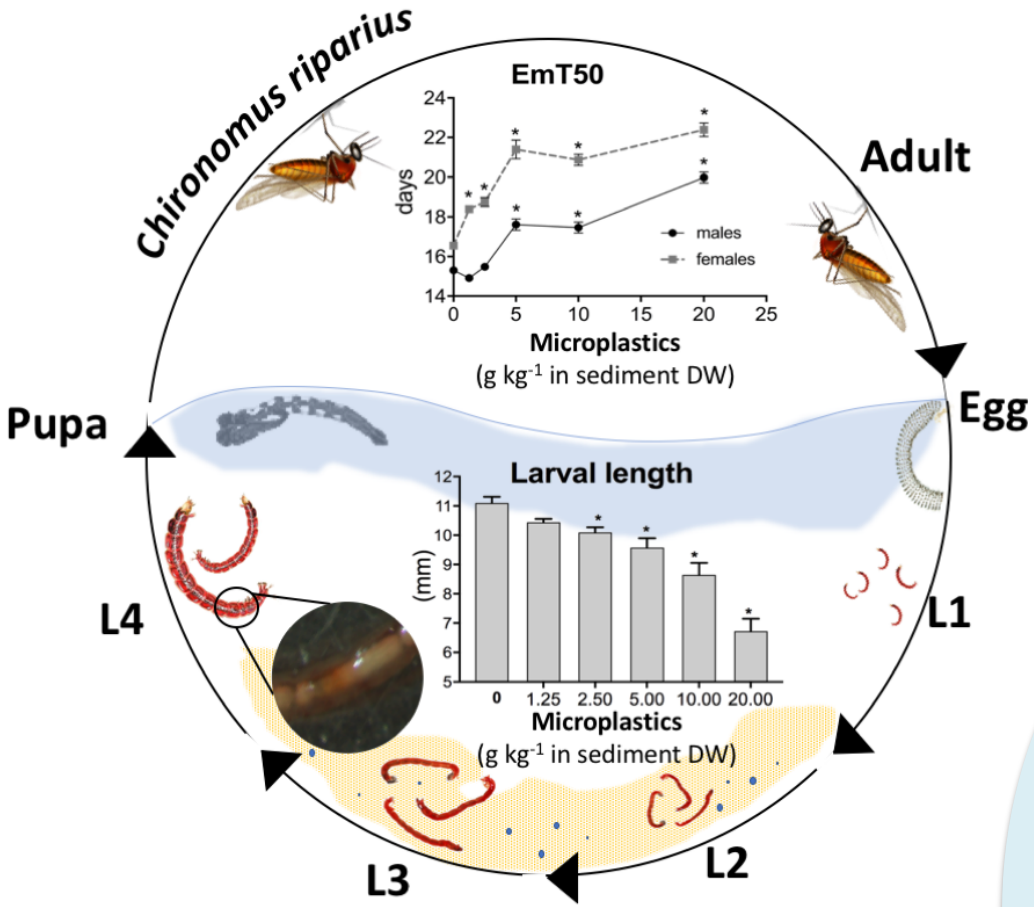
Ingestion of small-sized and irregularly shaped polyethylene microplastics affect *Chironomus riparius* life-history traits





Results so far

Life-history traits



Science of the Total Environment

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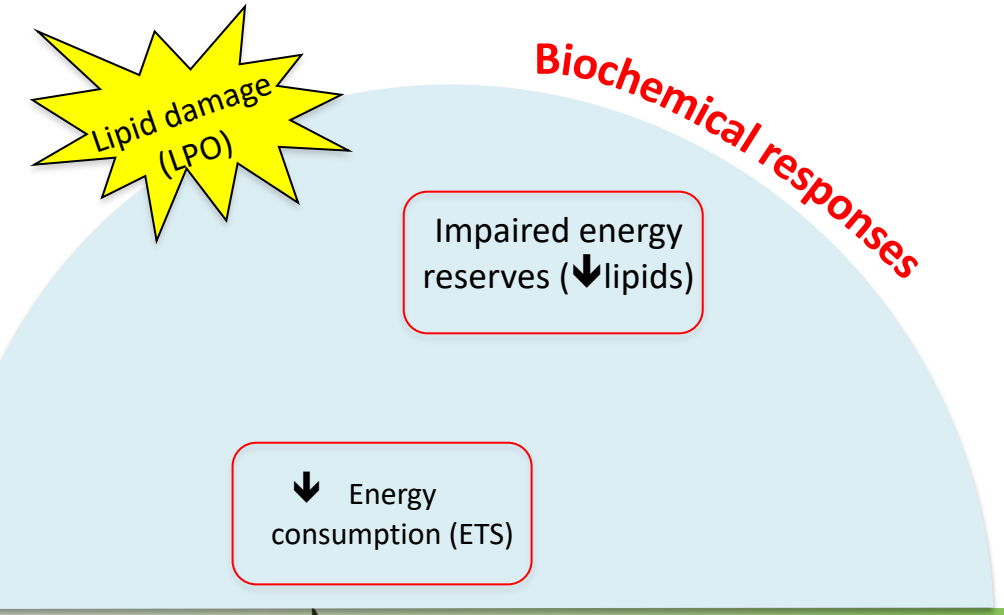

Dugesia sp.
(platelminta, predator)

Lumbriculus variegatus
(annelidae, detritivirous)

Project outcomes

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ECOTOXICOLOGICAL EFFECTS OF MICROPLASTICS ON FRESHWATER ENVIRONMENTS
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1) Increase the **knowledge regarding the presence and abundance of MPs in Portuguese rivers**

2) Provide **quality** (and **novel**) of **ecotoxicity data**:

→ benthic species

→ preliminary probabilistic **environmental risk assessment** for freshwater **benthic environments**

→ **Identify** potential **response mechanisms for MPs toxicity**

3) **Identify** potential **bioindicators** of MPs contamination in freshwater environments

A multidisciplinary Team ☺

Main team

Ana Silva (PI)
DeBio, Cesam-UA

Stress Ecology

Dick Vethaak
Deltares - VU

Water Quality

João Pestana (coPI)
DeBio, Cesam-UA

Freshwater Ecotoxicology

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Behavioural Ecotoxicology & Biochemistry

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Freshwater Ecotoxicology

Carlos Silva
DeBio, Cesam-UA

Freshwater Ecotoxicology (training)

Luisa Machado
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Freshwater Ecology

Teresa Rocha-Santos
DQ, Cesam-UA

Analytical Chem. Mitigation strategies

João Costa
DQ, Cesam-UA

Analytical Chem. Biotechnology

Joana Prata
DQ, Cesam-UA

Analytical Chem. Ecotoxicology (training)

External collaborators

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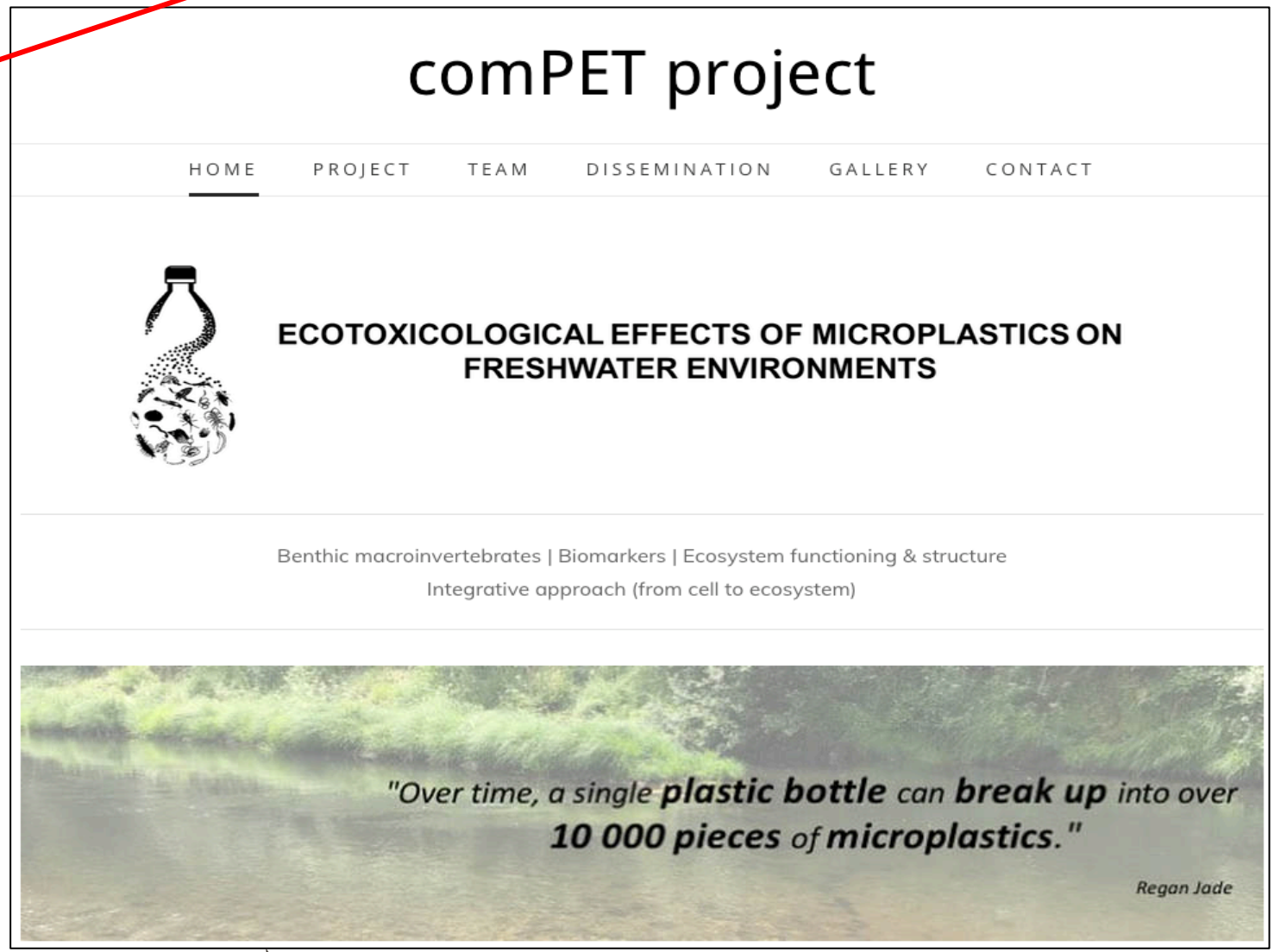

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